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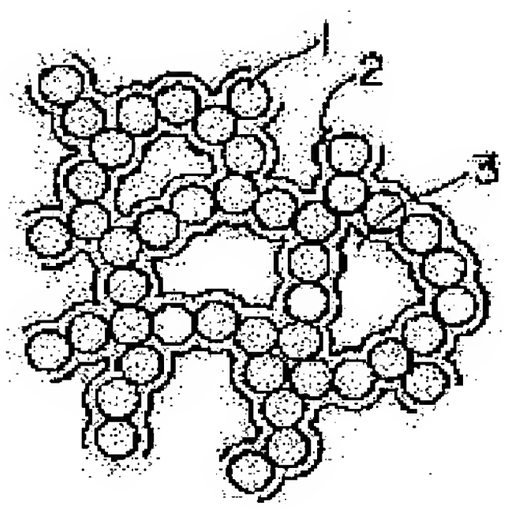
(54) RECORDING SHEET

(57)Abstract:
PURPOSE: To provide a recording sheet having a colorant receiving layer capable of obtaining a transparent image sheet by ink recording, thermal transfer recording or electrophotographic recording.
CONSTITUTION: In a recording sheet wherein a transparent colorant receiving layer is provided on a transparent support, the colorant receiving layer is one having a three-dimensional reticulated structure with voids of 50-80%. The three-dimensional reticulated structure is formed from fine silica particles 1 with an average primary particle size of 10nm or less and a water soluble resin and the wt. ratio of the fine silica particles 1 and the water-soluble resin 2 is 1.5:1-10:1.



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CLAIMS

[Claim(s)]
[Claim 1] The sheet for record characterized by for this color-material acceptance layer being a layer of the three-dimensional network which has 50 - 80% of voidage in the sheet for record with which it comes to prepare a transparent color-material acceptance layer on a transparence base material, and forming primary [an average of] particle diameter for this three-dimensional network from a silica particle and water soluble resin 10nm or less, and the weight ratio of this silica particle and water soluble resin being in the range of 1.5:1-10:1.
[Claim 2] The sheet for record according to claim 1 with which the pore which forms the opening of this three-dimensional network has the average diameter of 5-30nm.
[Claim 3] This silica particle is 2 1nm to a front face. Sheet for record according to claim 1 which is the silicic anhydride which has the silanol group of 2-3 hits.
[Claim 4] The sheet for record given in ****** claim 1 formed of connection of the aggregated particle which has the particle size this whose three-dimensional network is 10-100nm which the silica particle condensed.
[Claim 5] The sheet for record according to claim 1 this whose water soluble resin is polyvinyl alcohol.

[Translation done.]

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention relates to the record sheet recorded using color material. It is related with the record sheet for forming a transparency image sheet by ink record, thermal transfer recording, electrophotography record, etc. especially.
[0002]

[Description of the Prior Art] In recent years, the record approach and equipment which various information processing system was developed and fitted each information system are also developed and adopted with rapid development of an information industry. It miniaturizes, there is also no noise and the equipment used in such a record approach in the thermal-ink-transfer-printing record using the ink record using an ink jet or a plotter and melting mold color material, or sublimation mold color material has become a light weight and the thing excellent also in operability and maintainability. Furthermore, the equipment used by such record approach is widely used from colorization being easy recently. Moreover, colorization progresses also in the conventional electrophotography method, and the full color printer and the copying machine have been developed and commercialized with high resolution.
[0003] although the method of various kinds [method / ink jet] is developed -- an object -- there are three sorts, the approach using the coloring matter solution (water color ink) which roughly divides sexually and contains water-soluble coloring matter, the approach using the coloring matter solution (oily ink) containing oil solubility coloring matter, and the method of carrying out thermofusion of the low-melt point point solid wax (wax ink) containing coloring matter, and using it. The mainstream is a type which uses water color ink. Anyway, it is the approach of making an ink record sheet breathe out a liquefied particle drop, and forming an image.
[0004] It is the approach (heat-of-fusion imprint) of dividing a thermal-ink-transfer-printing method greatly, and it having two sorts of methods, and the 1st method carrying out heat impression of the ink of the thermofusion nature by which coating was carried out on the base material from a base material side, making it it carrying out melting to the shape of a pattern which carried out heat impression, making a record sheet-ed imprinting, and obtaining an image. The 2nd method is the approach (heat-of-sublimation imprint) of carrying out heat impression from a base material side like the former, making a sublimation color sublimating to the thermal recording ingredient which consists of the resin and the sublimability color of high softening temperature on a base material in the shape of [which carried out heat impression] a pattern, making a record sheet-ed imprinting, and obtaining an image. An electrophotography method has the approach in use of giving an optical pattern to the electrified photoconduction layer, forming an electrostatic latent image, imprinting to a record sheet-ed after toner development, and carrying out melting fixation of the toner with heat.
[0005] On the other hand, it is necessary to use a transparence sheet, and for the following applications, image formation of many is carried out as mentioned above using the bright film which prepared the color-material acceptance (absorption) layer in the front face, and they create a record sheet. For example, the OHP film whose opportunity used instead of a slide at a board etc. is increasing, the film for a back light display whose opportunity used instead of a printing poster or a display board is increasing, the film for mother prints, etc. can be mentioned.
[0006] The bright film by which image formation was carried out by these recording methods requires that color material should have pasted the front face of a record sheet-ed firmly in addition to the hue of the image obtained, saturation, and lightness, and further, in the case of ink jet record, when obtaining a minute image, liquefied ink is absorbed early, and it is required that there is neither ink NIJIMI nor ink ******. In order to solve these troubles, various proposals are made from the former. For example, in ink jet record, the activity of solubility or the bloating tendency matter is proposed by the activity of an absorptivity polymer at JP,55-146786,A, and is proposed by the above-mentioned color-material absorption layer at JP,56-80489,A, and many polymer systems (polyvinyl alcohol (PVA), a polyvinyl pyrrolidone (PVP), polyethylene oxide (PEO), carboxymethyl cellulose (CMC)) are proposed. However, the pass-through effect of the water color ink by the hydrophilic radical or dissociative radical of a polymer was used, even when the film was thickened, sufficient ink rate of absorption was not obtained, and these had inadequate control of a color mixture blot.
[0007] Moreover, the approach of carrying out ink absorption by capillarity is proposed by JP,63-22997,B, JP,63-56876,B, JP,3-21357,B, JP,3-48867,B, JP,57-14091,A, JP,60-61286,A, JP,60-214989,A, JP,61-22983,A, and JP,62-227684,A by using a color-material acceptance layer as porous membrane. Although these are comparatively high about ink absorptivity, since the

aperture of porous membrane is too large according to examination of this invention person, it is not suitable for the application as which light is scattered about (diffraction scattering, Mie scattering), and the permeability of light is required since optical transparency is low.
[0008] The method of furthermore using a porosity inorganic pigment for a color-material acceptance layer is proposed by JP,55-144172,A, JP,56-148584,A, JP,56-148585,A, JP,62-273881,A, JP,3-24906,B, JP,60-245588,A, etc. According to examination of this invention person, since the particle size of a pigment is too large, light scattering happens, and these cannot be referred to as that sufficient light transmission nature is shown, either. Moreover, the approach using various kinds of silica particles whose refractive indexes the approach using the non-subtlety particle of a specific refractive index is about 1.45 further at JP,61-53958,B and JP,61-60793,B is proposed by JP,55-51583,A (activity of a non-colloid silica), JP,56-148583,A (activity of a fines silicic acid), and JP,61-19389,A (activity of colloidal silica). Moreover, the approach of using it, making condense the gaseous-phase method silica of 10-30nm of diameters of a primary particle secondarily is proposed by JP,3-56552,B. However, in the color-material acceptance layer which used the porosity inorganic pigment as which only such a refractive index or particle diameter was specified, it became clear that sufficient transparency is not acquired.
[0009] The record sheet with which the color-material acceptance layer which has a detailed hole using a pseudo-boehmite system particle was formed on the other hand is indicated by JP,2-276670,A and JP,3-281383,A. According to examination of this invention person, although these were good about ink absorptivity, since a refractive index was as high as about 1.65, they became clear [that sufficient transparency is not acquired].
[0010]
[Problem(s) to be Solved by the Invention] Especially this invention person came examination in piles variously, in order to obtain the record sheet excellent in the above-mentioned ink absorptivity and transparency. And it became clear to be attained by preparing the color-material acceptance layer formed by making altitude distribute the amount of the binder for distributing this in the condition of having made it decreasing extremely, using the ultrafine particle of a silica on a transparence base material. Moreover, it became clear that the color-material acceptance layer obtained by making altitude distribute the ultrafine particle of a silica in this way had the three-dimensional network which has the opening which consists of very small pore with high voidage. According to such a three-dimensional network, coexistence of the above-mentioned ink absorptivity and transparency is enabled.
[0011] Therefore, this invention aims at offering the sheet for record which has the color-material acceptance layer which can obtain a transparent image sheet by ink record, thermal transfer recording, or electrophotography record. Moreover, transparency of this invention is high and it aims at offering the sheet for record excellent in the hue, saturation, and lightness of the obtained image. Furthermore, this invention absorbs liquefied ink promptly and aims at offering the high sheet for record of transparency suitable for the ink record which can obtain a minute image without ink NIJIMI or ink ******. Moreover, this invention aims at offering the high sheet for record of the transparency which color material pasted the front face of a record sheet-ed firmly in thermal transfer recording, and was excellent in toner adhesion and embossing-proof nature in electrophotography record.
[0012]
[Means for Solving the Problem] In the sheet for record with which it comes to prepare a color-material acceptance layer with the above-mentioned object transparent on a transparence base material A color-material acceptance layer is a layer of the three-dimensional network which has 50 - 80% of voidage. And the three-dimensional network can attain with the sheet for record characterized by forming primary [an average of] particle diameter from a silica particle and water soluble resin 10nm or less, and the weight ratio of a silica particle and water soluble resin being in the range of 1.5:1-10:1.
[0013] The desirable mode of the sheet for record of above-mentioned this invention is as follows.
1) The above-mentioned sheet for record with which the pore which forms the opening of a

three-dimensional network has the average diameter (average pole diameter) of 5-30nm.
2) The above-mentioned sheet for record with which the pore which forms the opening of a three-dimensional network has the pore capacity of 0.5 - 0.9 ml/g.
3) The above-mentioned sheet for record whose silica particle is a silicic anhydride.
4) A silica particle is 2 1nm to a front face. The above-mentioned sheet for record which has the silanol group of 2-3 hits.
5) The above-mentioned sheet for record with which a three-dimensional network consists of a chain formed of connection of the aggregated particle which has the particle size which is 10-100nm which the silica particle condensed.
6) The above-mentioned sheet for record whose water soluble resin is polyvinyl alcohol.
7) The above-mentioned sheet for record with which a color-material acceptance layer has the specific surface area of 100-250m2 / g.
8) The above-mentioned sheet for record with which a color-material acceptance layer has 70% or more of light transmission.
9) The above-mentioned sheet for record for ink jet record whose thickness of a color-material acceptance layer is 10-50 micrometers.
10) The object for electrophotography or the sheet for the above-mentioned record for thermal recording whose thickness of a color-material acceptance layer is 0.1-10 micrometers.
[0014] As mentioned above, in the case of water color ink, there are an approach of preparing the absorptivity polymer which has a hydrophilic radical and a dissociative polar group in a color-material acceptance layer, and the approach of making a color-material acceptance layer porous structure as an ink absorber style in ink record from the former. Although excelled in the point with few [ink absorptivity is high and] color mixture blots, since it is porosity and light transmission nature decreases by light scattering, the direction of the porous structure by capillarity is not suitable for the OHP film, the back light display, and the film for mother prints which are used with a transparency mold. In order to raise this light transmission nature and to consider as the structure where voidage is high, moreover, the specific silica of this invention which is the ultrafine particle of a very small particle size which has a refractive index before and behind 1.5 is distributed in dispersion liquid with a small amount of binder resin, and by carrying out spreading desiccation, the color-material acceptance layer in which the three-dimensional network which consists of an aggregated particle of this ultrafine particle was formed can be prepared on a transparence base material, and, thereby, can be attained.
[0015] That is, the sheet for record of this invention has the basic configuration which consists of a transparence base material and a transparent color-material acceptance layer formed on the base material. The color-material acceptance layer of this invention is a layer of the three-dimensional network which has 50 - 80% of voidage, and a three-dimensional network can be acquired, when the weight ratio of a silica particle and water soluble resin uses a silica particle and water soluble resin 10nm or less in 1.5:1-10:1 and primary [an average of] particle diameter forms.
[0016] The mimetic diagram showing the particulate structure (three-dimensional network) of the silica which forms the color-material acceptance layer of this invention is shown in drawing 1 . Moreover, the scanning electron microscope photograph of the particulate structure of the silica of drawing 2 and a cross section is shown for the scanning electron microscope photograph of the particulate structure of the silica of the color-material acceptance layer front face in drawing 3 . While the aggregated particle 1 to which the silica particle covered with water soluble resin 2 condensed the front face forms in drawing 1 the pore 3 which constitutes an opening, the three-dimensional network which connected mutually and was formed is shown. Moreover, drawing 2 and drawing 3 are the photographs taken by one 100,000 times the scale factor of this through the scanning electron microscope in the particulate structure of the silica seen in the front face and cross section of a color-material acceptance layer. It turns out that the mimetic diagram of drawing 1 and the three-dimensional network which corresponded mostly exist in the front face of a color-material acceptance layer, and the interior.
[0017] And a refractive index is 1.45. the silica particle which forms an aggregated particle 1 -- the first [an average of] particle diameter -- 10nm or less (preferably 3-10nm) -- Using this

silica particle and by making it distribute using water soluble resin in the amount of the above-mentioned range Since the three-dimension network structure which makes the aggregated particle of a particle a chain unit is formed and micropore is formed in the gap of this network, voidage is very high and the porosity membrane structure of light transmission nature is acquired. Generally, the surface area per weight (specific surface area) becomes large, and the effect of the particle interaction by the surface characteristic becomes strong as particle diameter becomes small. In the sol liquid which distributed the ultrafine particle to altitude in dispersion liquid for this reason, when particles collide in dispersion liquid, the probability for particles to adhere by a surface electrical property and hydrogen bond becomes high, that is, the so-called flocculation with few points of contact of particles (flocculation condition) arises, it becomes the three-dimensions network structure which this connected further, and wet gel arises. If this is dried and dispersion liquid evaporate, in three-dimensions network (reticulated) structure, a detailed opening will be generated and porosity xerogel will generate. If it interprets in a wide sense, it will be application of the method called sol gel process, and, as for this, formation of the color-material acceptance layer of this invention will also use this. the case where formation of an opening detailed in this three-dimensions network structure is so remarkable that a particle becomes small, and the first [an average of] particle diameter uses a silica particle (and the amount of above-mentioned within the limits -- water soluble resin -- combining) 10nm or less especially like this invention -- the pole diameter of 30nm or less with little light scattering -- and transparence porous membrane with large voidage can be formed.

[0018] In particles, for an adhesion and cone reason, the first [an average of] particle diameter can form the structure where voidage is large, as mentioned above by the hydrogen bond according [a silica particle] to a surface silanol group in the case of 10nm or less (preferably 3-10nm). A silica particle is divided roughly into a wet method and dry process according to a manufacturing method. The method of a wet method of the acidolysis of a silicate generating active silica, carrying out the polymerization of this moderately, carrying out flocking settling, and obtaining a water silica is in use. One dry-process silica has a method in use of obtaining an anhydrous silica by the approach (arc process) of carrying out heating hydride generation of the approach (flame hydrolysis), silica sand, and corks by elevated-temperature gaseous-phase hydrolysis of silicon halide with an arc in an electric furnace, and oxidizing this with air. In the case of a silicic anhydride (anhydrous silica), especially voidage is easy to form the high three-dimensional structure and is desirable [a silica] although these water silicas and an anhydrous silica show the property from which there was the difference of the consistency of a surface silanol group, the existence of a hole, etc., and it differed. This reason is 2 5-8 pieces/nm, when the consistency of a surface silanol group is a water silica, although it is not clear. Mostly, when it is easy to condense a particle densely (aggregate) and it is one anhydrous silica, it is 2 2-3 pieces/nm. Since it is few, it is presumed that it becomes **** flocculation (FUROKYU rate) and voidage becomes high structure.

[0019] As for the above-mentioned three-dimensional network, it is desirable to be formed of connection of the aggregated particle which has the particle size which is 10-100nm which the silica particle condensed, and it is desirable. [of further 20-50nm] Moreover, as for 50 - 80% of voidage of a three-dimensional network, it is desirable that it is 56 - 80%, as for the pore which forms the opening, it is desirable to have the average diameter (average pole diameter) of 5-30nm, and its 10-20nm is especially desirable. The capacity (pore capacity) of pore has desirable 0.5 - 0.9 ml/g, and further 0.6 - its 0.9 ml/g are desirable. Furthermore, the specific surface area of a color-material acceptance layer has the desirable range of 100-250m2 / g, and its 120-200m2 / g are especially desirable. Moreover, 70% or more of the light transmission of a color-material acceptance layer is desirable.

[0020] The following ingredient may be used in the range which does not spoil the object of this invention other than a silica particle. What has a refractive index in 1.40-1.60 from the point of not reducing transparency, as a particle used is desirable, for example, can mention colloidal silica, a calcium silicate, a zeolite, a kaolinite, halloysite, a muscovite, talc, a calcium carbonate, a calcium sulfate, etc.

[0021] In this invention, in order to make easy formation of the three-dimensions style which is a

color-material acceptance layer (film) and to raise the film reinforcement, and in order to prevent the cracking crack of the film at the time of desiccation, water soluble resin is used as a binder with a silica particle. The ratio (PB ratio: weight of the silica particle to the weight 1 of water soluble resin) of this silica particle and water soluble resin has big effect also on membrane structure. If PB ratio becomes large, voidage, pore volume, and surface area (per unit weight) will become large. When 10 is exceeded, there is no effectiveness over film reinforcement and the cracking crack at the time of desiccation, less than by 1.5, an opening is closed by resin, voidage decreases and ink absorptivity ability falls. For this reason, the range of 1.5-10 is suitable for PB ratio. In order to acquire high-speed ink absorptivity with an ink jet printer, as for especially PB ratio, two or more are desirable [to touch directly by hand like especially an OHP film, it is necessary to obtain sufficient film reinforcement, as for especially PB ratio, five or less are desirable, and], therefore the range of 2-5 is still more suitable for PB ratio.

[0022] For example, when the first [an average of] above particle diameter distributed thoroughly [PB ratio / 2-5] in a water solution an anhydrous silica and water soluble resin 10nm or less and carries out spreading desiccation, The three-dimensional network which makes the aggregated particle of a silica particle a chain unit is formed, average pore is 30nm or less, and voidage is 50% or more and pore specific volume 0.5 ml/g. Specific surface area can form easily the porous membrane (color-material acceptance layer) of the translucency more than 100m2/g above.

[0023] As an example of water soluble resin, as resin which has hydroxyl as a hydrophilic structural unit polyvinyl alcohol (PVA) and cellulose type resin (methyl cellulose (MC) --) Ethyl cellulose (EC), hydroxyethyl cellulose (HEC), A carboxymethyl cellulose (CMC) etc. chitins and starch as resin which has; ether linkage Polyethylene oxide (PEO), Polyacrylamide (PAAM) and a polyvinyl pyrrolidone (PVP) can be mentioned as resin which has;, an amide group, and amide association for polypropylene oxide (PPO), a polyethylene glycol (PEG), and polyvinyl ether (PVE). Moreover, the poly allylamine (PAA) which has the polystyrene sulfonate salt which has; sulfone radical for the polyacrylate which has a carboxyl group as a dissociative radical, maleic resin, alginate, and gelatin, the amino group, an imino group, tertiary amine, and the 4th ammonium salt, polyethyleneimine (PEI), an epoxidation polyamide (EPAm), polyvinyl pyridine, and gelatin can be mentioned. The class of resin combined with a silica particle from a viewpoint of transparency is important, and when it is an anhydrous silica, PVA, especially the low saponification degree (70 - 90% of saponification degrees [Preferably]) PVA are suitable in respect of light transmission nature. Although PVA has a hydroxyl group in a structural unit, this hydroxyl group and the silanol group of a silica particle front face form hydrogen bond, and it is considered with making easy to form the three-dimensional network which makes the aggregated particle of a silica particle a chain unit. It is thought that the color-material acceptance layer of the structure where voidage is high is obtained by this. Thus, not only the minute record which absorbs ink quickly by capillarity and has neither ink NIJIMI nor ink ****** is possible, but the obtained color-material acceptance layer can paste up firmly the color material in thermal recording, and the toner in electrophotography record in ink jet record. This reason is because color material etc. is firmly fixed according to the geometrical anchor effect to which color material and a toner go underwater in the pore of a porous layer, and originate in a three-dimensional network as that result. Moreover, since there are many rates of a non-subtlety particle, there is the description that thermal resistance is high and the embossing-proof nature in electrophotography record is also high.

[0024] In ink jet record, the thickness of a color-material acceptance layer needs to have the absorption capacity which absorbs all drops, and it is necessary to determine this in connection with the voidage of a paint film. For example, the amount of ink 8nl/mm2 By the case, if voidage is 60%, film about 15 micrometers or more is needed. In in ink jet record, the range of 10-50 micrometers is desirable. Since color material or a toner is adsorbed on a front face, in the case of thermal ink transfer printing or an electrophotography method, a thin film is enough, and it is desirable. [of 0.1-10 micrometers]

[0025] A single raw material is sufficient as the silica particle and water soluble resin which

mainly constitute this color-material acceptance layer, respectively, and the mixed stock of two or more raw materials is sufficient as them. moreover, the color-material acceptance layer may contain acid alkali as various kinds of mineral and a PH regulator, in order are alike other than this and to raise the dispersibility of a particle, although it mainly consists of a silica particle and water soluble resin. Moreover, various kinds of surfactants for the object which raises spreading fitness and surface quality may be used. In order to control surface frictional electrification and exfoliation electrification, or in order to adjust surface electric resistance in a xerography, the metallic-oxide particle with a surfactant with ion conductivity or electronic conductivity may be included. Moreover, a mordant may be used in order to fix coloring matter in ink record and to raise a water resisting property. Moreover, various kinds of mat agents for the object which reduces a surface friction property may be included. Moreover, various kinds of antioxidants for the object which controls degradation of color material, and an ultraviolet ray absorbent may be included.

[0026] Moreover, between a color-material acceptance layer and a transparence base material, an adhesive property may be raised or undercoat may be prepared for the object of adjusting electric resistance. Furthermore, a color-material acceptance layer may be prepared in both sides, in order to prepare in one side of a transparence base material and to control curl etc. Moreover, an antireflection film may be prepared in order to raise light transmission nature to the reverse side, when preparing a color-material acceptance layer only in one side. For the refractive index (nr) of this antireflection film, the refractive index of a transparence base material is ns. It is desirable that the case of near and its thickness is close to lambda/4n to ns 1/2 (however, lambda is the wavelength of the OHP lamp to be used).

[0027] The film which can be used as the above-mentioned transparence base material is transparent, and if it is an ingredient which has the property to bear the radiant heat when being used on OHP or a back light display, it can be used. As the ingredient, polysulfone, polyphenylene oxide, polyimide, a polycarbonate, a polyamide, etc. can be mentioned to cellulose ester, such as polyester; nitrocelluloses, such as polyethylene phthalate, cellulose acetate, and cellulose acetate butylate, and a pan. In these, polyethylene phthalate is desirable. Its thickness of a film is easy to deal with a 50-200-micrometer thing and is desirable although there is especially no limit. Moreover, a base material film may use what performed corona discharge treatment, flame treatment, and UV irradiation processing.

[0028] A color-material acceptance layer can be prepared, for example on a transparence base material as follows. The coating liquid for color-material acceptance stratification the silica particle of 10nm or less of diameters of an average primary particle underwater -- adding (an example, 10 - 15 % of the weight) -- a high-speed revolution wet colloid mill (an example ---) After carrying out distribution for 20 minutes (preferably for 10 - 30 minutes) on condition that the high-speed revolution of 10000rpm (preferably 5000 - 20000rpm), using a KUREA mix (M Technique Co., Ltd. make), A polyvinyl alcohol water solution (it is set to PVA of about 1/3 weight of an example and a silica like) can be added, and it can distribute on the still more nearly same conditions as the above, and can obtain by subsequently to 4-5 adjusting pH. Thus, the obtained coating liquid is a homogeneity sol and can obtain the color-material acceptance layer which has the three-dimensional network of this invention by forming this on a transparence base material by the following method of application. That is, the water which is a solvent is evaporated by drying, after applying the coating liquid of the above-mentioned homogeneity sol on a base material. When the spreading film reaches gelation concentration by this evaporation, wet gel is formed, when desiccation advances further, porosity xerogel is formed and the color-material acceptance layer of this invention can be obtained.

[0029] Formation of the above-mentioned color-material acceptance layer can carry out the coating liquid which added the antistatic agent etc. to for example, the above-mentioned coating liquid further by request, and was obtained spreading and by carrying out stoving on the above-mentioned bright film. Spreading can be performed by the well-known methods of application, such as for example, the Ayr doctor coating machine, a bread coating machine, a rod coating machine, a knife coating machine, a squeeze coating machine, a reverse roll coater, and a bar coating machine. desiccation -- hot air drying equipment -- comparatively -- low temperature -

- (-- preferably, after drying for 0.5 - 3 minutes by 50 - 90 degree-C(3-8m [/second] wind speed)), it is desirable from the point of the crack prevention at the time of desiccation of a color-material acceptance layer when especially thickness is thick to dry further comparatively at an elevated temperature (preferably 120-180 degrees C for 5 - 20 minutes). Moreover, it is possible by letting between roll nips pass under heating and application of pressure after spreading and desiccation (for example, a supercalender) and with gloss calender etc. to raise surface smooth nature, transparency, and paint film reinforcement. However, decline in voidage needs to perform such processing by setting up few conditions in order to reduce voidage (namely, in order for ink absorptivity to fall).

[0030]

[Example]

[0031] [Example 1]

(1) The presentation of the coating liquid for color-material acceptance stratification (all the values of the weight section which shows the loadings of all the following coating liquid express solid content or a nonvolatile matter)

** Dry type silica particle (primary [an average of] particle diameter: 7nm; 10 weight section refractive index : 1.45; surface silanol group : 2 - 3-/nm2;)

Aerosil A300 (product made from Japanese Aerosil)

** Polyvinyl alcohol (88% of saponification degrees; polymerization-degree 3500; 3.3 weight section PVA235 (Kuraray Co., Ltd. make))

** Ion exchange water The silica particle of 136.0 weight sections ** is added in the ion exchange water (73.3 weight sections) of **. A high-speed revolution wet colloid mill (KUREA mix (M Technique Co., Ltd. make)) is used. After making it distribute for 20 minutes on condition that 10000rpm, the polyvinyl alcohol water solution (what was dissolved in the remainder 62.7 weight section of ion exchange water) was added, it distributed on the further still more nearly same conditions as the above, subsequently to 4-5 pH was adjusted, and the coating liquid for color-material acceptance stratification was obtained.

[0032] (2) After having carried out corona discharge treatment of the polyethylene terephthalate front face where the thickness of 100 micrometers carried out biaxial stretching of the coating liquid of spreading ******, using and applying the air knife coater to the front face and drying for 1 minute at 70 degrees C (5m [/second] wind speed) with hot air drying equipment, it dried for 10 minutes at 150 more degrees C. Thereby, desiccation thickness formed the color-material acceptance layer which is 30 micrometers. This obtained the sheet for record for ink jets. The scanning electron microscope photograph (100000 times) of the front face of the obtained color-material acceptance layer and a cross section is shown in drawing 2 and drawing 3 , respectively. These photographs show that the obtained color-material acceptance layer has a three-dimensional network.

[0033] It sets in the [example 1 of comparison] example 1, and is a dry type silica particle (the sheet for record for ink jets was produced like the example 1 except having used refractive-index 1.45;MOX-80 (product made from Japanese Aerosil).) with a primary [an average of] particle diameter of 30nm instead of a dry type silica particle with a primary [an average of] particle diameter of 7nm.

[0034] It sets in the [example 2 of comparison] example 1, and is an alumina particle (the sheet for record for ink jets was produced like the example 1 except having used refractive-index 1.75;Aluminium Oxide C (product made from Japanese Aerosil).) with a primary [an average of] particle diameter of 13nm instead of a dry type silica particle with a primary [an average of] particle diameter of 7nm.

[0035] In the [example 3 of comparison] example 1, the sheet for record for ink jets was produced like the example 1 except having changed the presentation of the coating liquid for color-material acceptance stratification into the following presentation.

** Dry type silica particle (primary [an average of] particle diameter: 7nm; 6.65 weight section refractive index : 1.45; surface silanol group : 2-3-piece/nm2;)

Aerosil A300 (product made from Japanese Aerosil)

** Polyvinyl alcohol (88% of saponification degrees; polymerization-degree 3500;6.65 weight

section PVA235 (Kuraray Co., Ltd. make))
** Ion exchange water The 86.7 weight sections [0036] About the sheet for record for ink jets obtained above, the ink jet fitness was evaluated by the following measuring methods.
(1) With the ink rate-of-absorption ink jet printer (PIXEL JET; product made from Canon), the contact press of the paper was carried out immediately after solid printing of the red to the sheet for record, yellow, blue, and black (after about 10 seconds), and it judged as follows by the existence of the imprint to the paper of ink.
AA: Ink was not imprinted by paper.
CC: Ink was imprinted by paper.
(2) it can set using the same printer as the ink color mixture blot above on the red and yellow which were printed by the sheet for record, blue, and a black solid printing section boundary -- it oozed out and judged with extent.
AA: It oozes and was poor.
BB: It oozed and ** was accepted for a while.
CC: It oozed out, and it became in ** and accepted.
(3) The diameter of the dot printed by the sheet for record of black ink was measured under the microscope using the same printer as the diameter above of a dot.
(4) The red and yellow which were printed by the sheet for record, blue, and the black solid printing section were measured with the optical-density plan (product made from X-Rite310 TR;X-Rite) using the same printer as the depth-of-shade above. The result of the above-mentioned assessment is shown in the following table 1.
[0037]
[A table 1]
Table 1---------- Ink Ink Dot Color ** Whenever Absorption Color mixture Diameter Yellow Blue Red Black Rate It spreads. (micrometer)
---------- Example 1 AA AA 101 1.50 1.28 1.48 1.69 ---------- ---------- Example 1 of a comparison AA AA 108 1.42 1.21 1.40 Example 2 of 1.66 comparisons AA AA 107 1.46 1.26 1.41 Example 3 of 1.67 comparisons CC BB 122 1.38 1.11 1.40 1.59 ---------- ---------- [0038] About the sheet for record for ink jets obtained above, the physical property was evaluated by the following measuring methods.

(5) Parallel ray permeability was measured using the parallel ray permeability hazemeter (HGM-2DP; Suga Test Instruments Co., Ltd. make).
(6) They calculated the average by having measured an average pole diameter, (7) voidage, (8) pore specific volume, and (9) specific surface area using the mercury porosimeter (pore sizer 9320-PC2; Shimadzu Corp. make), and having acquired each distribution.
(10) it asked by observing the secondary particle-size profit **** color-material acceptance layer of a silica particle with a scanning electron microscope. The result of the above-mentioned assessment is shown in the following table 2.
[0039]
[A table 2]
Table 2---------- Permeability Pole diameter Voidage Pore specific volume Specific surface area Secondary particle size (%) (nm) (% (V/V)) (ml/g) (m2/g) (nm)
---------- An example 1 81.3 15 61 0.77 162 40 ---------- ---------- The example 1 of a comparison 62.0 35 43 0.45 83 140 The example 2 of a comparison 40.2 21 51 0.52 103 110 Example 3 of a comparison 68.3 1232 0.38 114 40 ---------- ---------- [0040] [Example 2]
(1) The presentation of the coating liquid for color-material acceptance stratification (all the values of the weight section which shows the loadings of all the following coating liquid express solid content or a nonvolatile matter)
** Dry type silica particle (primary [an average of] particle diameter: 7nm; 1 weight section refractive index : 1.45; surface silanol group : 2 - 3-/nm2;)
Aerosil A300 (product made from Japanese Aerosil)

** Polyvinyl alcohol (88% of saponification degrees; polymerization-degree 3500 0.33 weight section PVA235 (Kuraray Co., Ltd. make))
** Ion exchange water The silica particle of 147.97 weight sections ** is added in the ion exchange water (the great portion of 82.3 weight sections) of **. A high-speed revolution wet colloid mill (KUREA mix (M Technique Co., Ltd. make)) is used. After making it distribute for 20 minutes on condition that 10000rpm, the polyvinyl alcohol water solution (what was dissolved in the remainder 65.67 weight section of ion exchange water) was added, it distributed on the further still more nearly same conditions as the above, subsequently to 4-5 pH was adjusted, and the coating liquid for color-material acceptance stratification was obtained.
[0041] (2) Corona discharge treatment of the polyethylene terephthalate front face where the thickness of 100 micrometers carried out biaxial stretching of the coating liquid of spreading ****** was carried out, #12 bar air knife coater was used and applied to the front face, and it dried for 10 minutes at 100 degrees C with hot air drying equipment. Thereby, desiccation thickness formed the color-material acceptance layer which is 0.5 micrometers. This obtained the sheet for record for electrophotography. When the obtained color-material acceptance layer was observed with the scanning electron microscope (100000 times), it was admitted that a color-material acceptance layer had a three-dimensional network.
[0042] It sets in the [example 4 of comparison] example 1, and is a dry type silica particle (the sheet for record for electrophotography was produced like the example 1 except having used refractive-index 1.45;MOX-80 (product made from Japanese Aerosil).) with a primary [an average of] particle diameter of 30nm instead of a dry type silica particle with a primary [an average of] particle diameter of 7nm.
[0043] It sets in the [example 5 of comparison] example 1, and is an alumina particle (the sheet for record for electrophotography was produced like the example 1 except having used refractive-index 1.75;Aluminium Oxide C (product made from Japanese Aerosil).) with a primary [an average of] particle diameter of 13nm instead of a dry type silica particle with a primary [an average of] particle diameter of 7nm.
[0044] Thus, the following approach estimated the property for the obtained film for record for electrophotography.
11) The toner adhesion electrophotography copying machine (VIVACE-120; Fuji Xerox make) copied, the whole surface carried out the Scotch tape friction test of the part (black solid part) of an image about the obtained copy film, the optical density of the toner image before and behind Scotch tape exfoliation was measured with the optical-density plan (X-Rite310TR, product made from X-Rite), and the bottom type estimated toner adhesion.

$$\frac{\text{セロテープ剥離後の光学濃度}}{\text{セロテープ剥離前の光学濃度}} \times 100 \quad (\%)$$

[0045] 12) The same electrophotography copying machine as the embossing-proof nature above copied the image, the concavo-convex nonuniformity (if irregularity becomes large, lowering of smooth nature will be brought about) existence of a film was visually observed about the obtained copy film, and embossing-proof nature was evaluated as follows.
AA: There was no concavo-convex nonuniformity of copy film **.
CC: There is concavo-convex nonuniformity of copy film **, and smooth nature was falling.
[0046] 13) The same electrophotography copying machine as the toner imprint concentration above copied the image, and the optical density of the black solid part of the obtained copy film was measured with the optical-density plan (X-Rite310TR, product made from X-Rite).
Moreover, it measured also about the physical property of aforementioned (5) - (10). The above-mentioned measurement result ((5) - (10) and (11) - (13)) is shown in the following table 3.
[0047]
[A table 3]
A table 3 ---------- Adhesive property En-proof Imprint Permeability Pole diameter Voidage Pore Ratio table Secondary Boss nature Concentration Specific volume Area Particle size (%) (%), (nm) () [%(V/V) (ml/g) (m2/g) (nm)] ----------

---------- Example 283AA 1.14 87 15 60 0.77 162 40 ---------- ---------- Example 4 of a comparison 69 AA 1.11 82 35 43 0.45 83140 Example of comparison 573 AA 1.12 87 21 51 0.52 103 110 ----------

[0048]

[Effect of the Invention] The sheet for record of this invention is a sheet for transparence record which the minute image which absorbs liquefied ink early in ink record, and has neither an ink blot nor ink ****** was obtained, and color material pasted the front face of a record sheet-ed firmly in thermal transfer recording, and was excellent in toner adhesion and embossing-proof nature in electrophotography record. The sheet for record of this invention has a refractive index near 1.5 from which high transparency is easy to be acquired, dispersion reinforcement distributes the specific silica of the ultrafine particle of a small very small particle size in dispersion liquid with a small amount of binder resin at altitude, it is carrying out spreading desiccation and the color-material acceptance layer in which the three-dimensional network which has the minute pore which consists of an aggregated particle of this ultrafine particle was formed is prepared on a transparence base material. Therefore, this color-material acceptance layer has the high voidage which is the layer of the three-dimensional network which has minute pore. That is, since minute pore is formed of the three-dimensional network formed by connection of the aggregated particle of the silica particle of the refractive index near 1.5, transparency with it is shown. [there is little light scattering and high] Moreover, with high voidage, the adhesive property of color material or a toner improves in the absorptivity of ink, blot prevention, and thermal transfer recording and electrophotography record. From the reason for the above, it can be said that the sheet for record of this invention is a transparent sheet for record suitable for the various record approaches.

[Translation done.]

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is the mimetic diagram showing an example of the particulate structure of the silica which forms the color-material acceptance layer of this invention.

[Drawing 2] It is the scanning electron microscope photograph of an example of the particulate structure of the silica which forms the front face of the color-material acceptance layer of this invention.

[Drawing 3] It is the scanning electron microscope photograph of an example of the particulate structure of the silica which forms the cross section of the color-material acceptance layer of this invention.

[Description of Notations]

1 Aggregated Particle Which Silica Particle Condensed
2 Water Soluble Resin
3 Pore

[Translation done.]

* NOTICES *

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2.**** shows the word which can not be translated.
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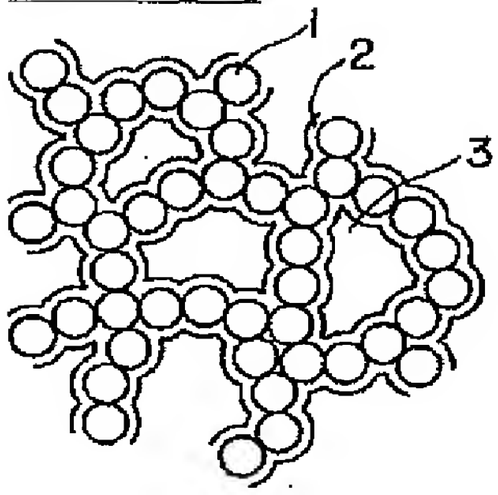
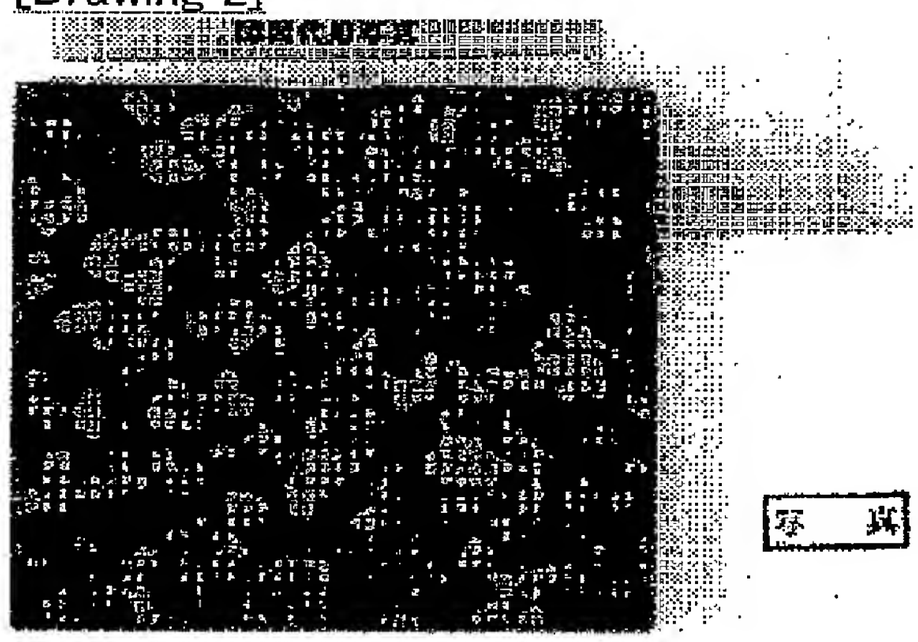
DRAWINGS

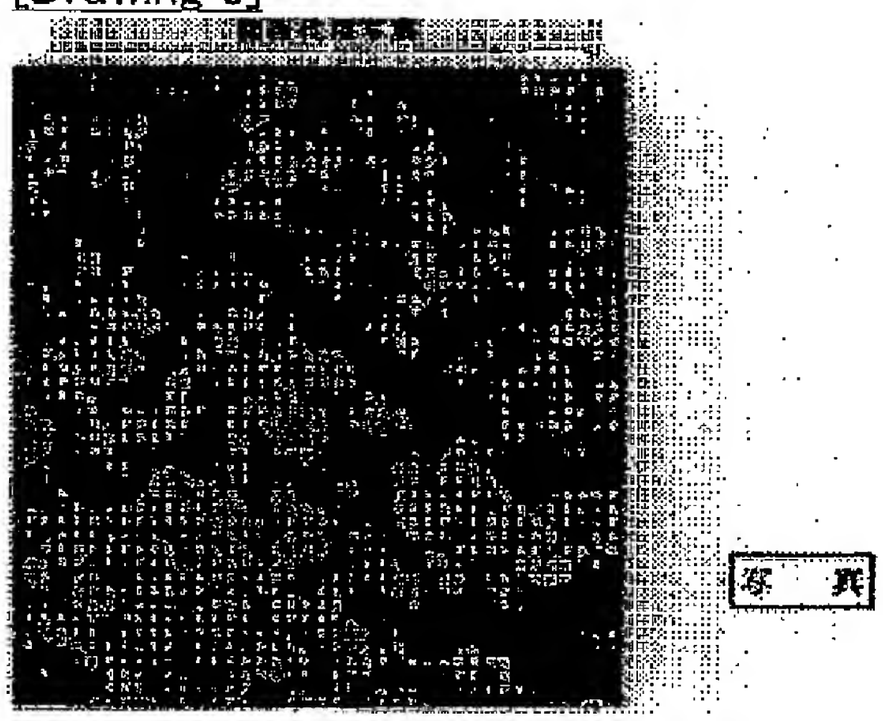
[Drawing 1]



[Drawing 2]



[Drawing 3]



[Translation done.]